A Progression of Study Options

Deciding upon the appropriate "degree of resolution" is a major issue in flow-recreation studies. Some rivers have extensive recreation use that is clearly flow-dependent and affected by project operations; here more intensive and detailed efforts are necessary. On other rivers, the potential for a recreation use may be unknown (e.g., whitewater boating on a bypass reach, fishing for a species that could be reintroduced), or the use may be only marginally affected by flows that the project does not substantially affect. In these cases, less intensive studies may be required.

Given the potential diversity of situations, it is difficult to specify a single set of standards for a "sufficient" study. Instead, we recommend a progressive approach with "phased" efforts of increasing resolution. All studies have to provide similar initial information about recreation opportunities, their likely dependency on flows, and potential project effects. However, more intensive or detailed studies will only be prescribed in situations that merit them. To be effective, this approach needs 1) a clear sequential framework; 2) standardized terminology for various study options; 3) agreement about which study options provide which degree of resolution; and 4) explicit decision criteria to help determine whether the study needs to continue to the next level.

The following framework suggests three levels of resolution, with distinct study options generally linked to each level:

• **Level 1** – "desk-top" options: This is the initial information collection and integration phase. It usually focuses on "desk-top" methods using existing information, or limited interviews with people familiar with flows and recreation on the reach.

• **Level 2** – limited reconnaissance options: This increases the degree of resolution through limited reconnaissance-based studies, more intensive analysis of existing information, or more extensive interviews.

• **Level 3** – intensive studies: This substantially increases the degree of resolution through more intensive studies, which may include multiple flow reconnaissance, flow comparison surveys, or controlled flow studies.

This framework has been applied successfully in FERC relicensing proceedings, and it has the potential to improve studies or applications in several ways. First, it focuses resources on those river reaches with greater interest to the recreation community or with greater impacts from project operations, while reducing workloads on reaches with less interest and lesser project effects. This streamlines costs by prioritizing reaches more "deserving" of additional study. This is especially useful at hydropower projects with multiple dams, powerhouses, and river reaches, where prioritization and efficiency are particularly important.

Second, it provides a transparent and defensible record for all entities (e.g, Licensees, stakeholder groups, and agencies) regarding the "sufficiency" of effort. This should lead to more efficient licensing or adjudication proceedings, and limit challenges.

Third, it helps standardize methodologies and improves comparability across situations. This should improve the quality of study products and allow them to be more efficiently used in license proceedings or other decision-settings.

Fourth, the increased transparency of the phased approach allows information to be shared earlier in the process, particularly across resources. This allows an earlier discussion of potential conflicts between flow needs for different resources, which may help researchers design studies that address solutions to those conflicts. Integrating information across resources is a major challenge in licensing proceedings; the earlier potential conflicts are articulated, the more likely researchers can provide information about trade-offs or potential ways to address them.

Finally, there are efficiencies in conducting coordinated studies, particularly if controlled flow releases are part of the study design. Although it is beyond the scope of this report, there appear to be similar benefits of using a progressive approach with aesthetics, fisheries, or other resource studies, with parallel types of work at the desk-top, initial reconnaissance, and intensive study levels. Formally recognizing these levels and coordinating study needs can help reduce the costs of studies and encourage inter-disciplinary exchanges throughout the study process.

The remainder of this guide reviews elements for each study option, including 1) objectives; 2) typical approaches; 3) products; 4) typical responsibilities of agencies, utilities, and advocacy groups; 5) "additional issues" to highlight challenging tasks or suggest protocols that characterize more successful efforts; and 6) "cautions or limitations" that may restrict use of an option or require additional information from other study options.

Intensive studies are needed when recreation opportunities are flow-dependent and affected by project operations. Above: Boating on Oregon's Upper Klamath River is dramactically affected by a power-peaking regime that can fluctuate from 350 and 2,800 cfs in one day. A controlled flow study examined flows between 700 and 1,700 cfs (shown here) to more precisely specify flow ranges for different opportunities if peaking operations were constrained.

Desk-Top Options (Generally Level 1)

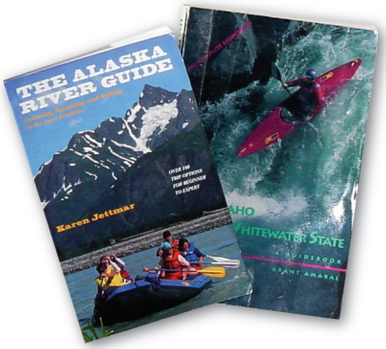
"Desktop analysis" options are useful for developing information about existing or potential recreation opportunities, facilities, physical characteristics of the river, and recreation-relevant hydrology. In some cases, desktop methods may help develop rough estimates of flow ranges for different opportunities. The three options are:

- *Literature reviews*
- *Hydrology summary*
- *Structured interviews*

While these could be done as Level 1 efforts that are part of a first-stage consultation package or pre-application document (PAD), they may also be employed more intensively as part of Level 2 efforts.

Under new ILP rules, resource agencies and FERC discourage significant analysis of existing information without a study plan (particularly if the PAD is being developed without extensive agency or stakeholder input), with the standard being "existing, relevant, and reasonably available information."

Literature Reviews

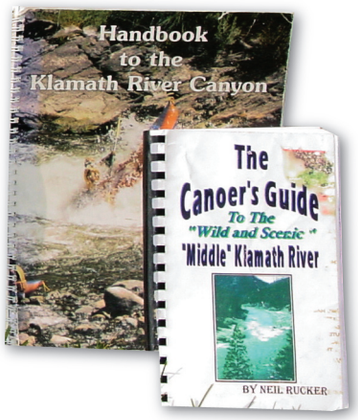


Objective
Review and summarize existing documents with information about recreation opportunities or the river's physical characteristics that make it attractive for recreation.

Typical approach
Literature searches via the web, libraries, or agency collections, with systematic documentation of sources and findings. The effort may include summaries or basic analysis of agency use information.

Product
Summary of recreation opportunities, facilities, use, and physical characteristics in a report.

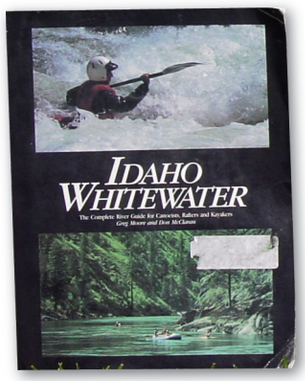
Responsibilities
Utilities (or their consultants) have primary responsibility, but agencies and stakeholders may provide documents or access to files.



Additional issues
A "brainstorming" session among agencies and stakeholders may help identify documents; physical searches of agency files sometimes produce useful "gray literature" or use statistics.

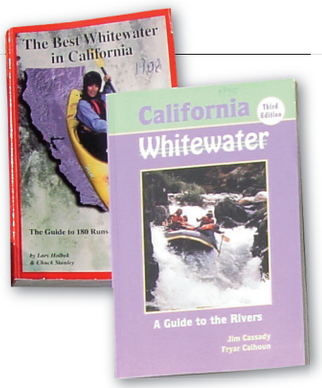
Physical characteristics that should be listed for any segment include: length, gradient, channel type, access locations, and facilities.

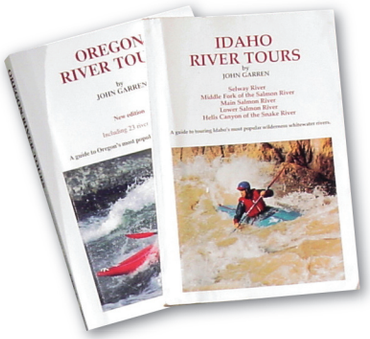
Extensive analysis of use data is usually unnecessary at this stage, but a summary of typical averages and peak levels can be helpful. Qualitative discussion of seasonal or weekly use patterns may also be important.

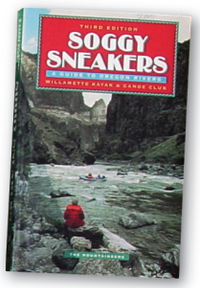


The summary should be systematic and comprehensive, organizing information by recreation opportunities and associating appropriate physical characteristics or use data with each.

Cautions & limitations:
Guidebooks are often a good "first source" for a river's physical characteristics and general description, but flow ranges or hydrology information from them should be used with caution. The level of accuracy and rigor varies considerably among guidebooks, and evaluations represent the opinion of the author(s) only.







Level 1 literature reviews include guidebooks, which provide general information about river characteristics and types of recreation opportunities. Boating guides often discuss flows and gages, and may recommend flows for different skill levels. However, guidebooks are essentially the opinion of a single author, and the "quality" of those opinions varies depending upon the author's skill, experience, and the level of detail they provide.

Hydrology Summary

Objective
Summarize recreation-relevant hydrology, describe project "plumbing," and identify existing and potential operational constraints on existing or alternative flow regimes.

Typical approach
Search for relevant summary hydrology data, usually from the USGS, state water resource departments, land managing agencies, and utilities. Assemble and summarize recreation-relevant findings that may include graphs and tables for typical or example recreation seasons.

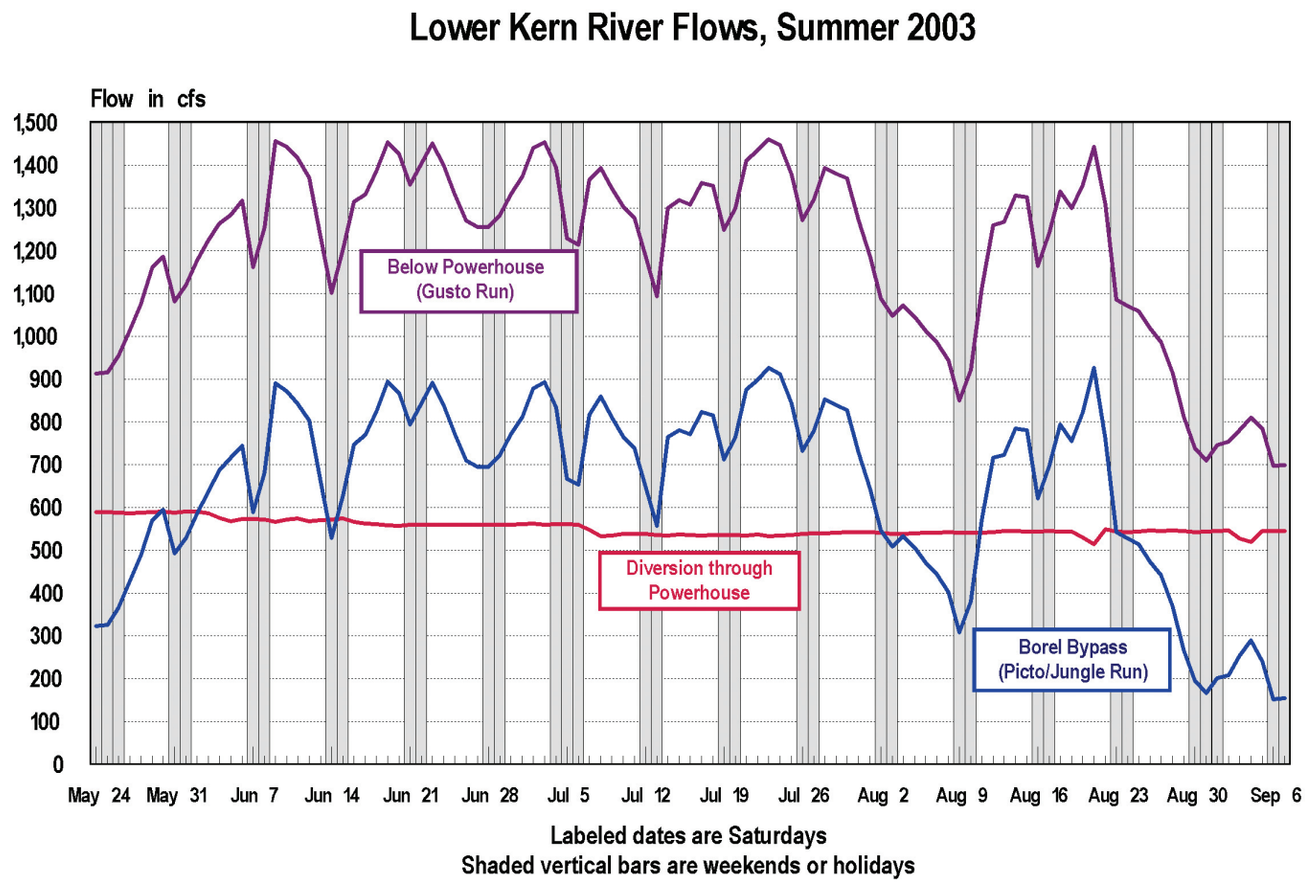
Product
Summary hydrology section in a report.

Responsibilities
Utilities (or their consultants) have primary responsibility, but agencies may be able to provide access to key hydrology data or summaries to make this effort efficient (and non-duplicative).

Additional issues
The amount of analysis and presentation involved in this task depends on the resolution needed. For a Level 1 report, summaries of existing information or example hydrographs from an average year may be adequate; more intensive analyses and presentations are usually necessary to reach a higher degree of precision common for a Level 2 or 3 effort.

Cautions & limitations
Daily, monthly, or annual averages are often used to summarize hydrology, but these statistics may be insufficient if they mask important variability. For example, averages at a daily peaking facility may not reflect a flow that occurs for any substantial length of time.

In nearly all cases, summary hydrology data for a key gage or hydrology reports for the larger relicensing effort will not be sufficient. Raw hydrology data, gage statistics, project operational constraints, and similar information commonly need to be "re-packaged" to focus on recreation-relevant flows or seasons. The goal is a clear and concise summary to illustrate how the system works or could be operated to provide flows for recreation.



Summarizing recreation-relevant hydrology usually involves re-organizing hydrology records. Above: Daily hydrographs for two segments on California's Lower Kern River illustate variable irrigation releases coupled with a steady hydropower diversion. Organizing information for an example recreation season shows how flows drop on weekends (adversely affecting boating).

Structured Interviews

Objective
Collect and organize information about "local knowledge" of the river, recreation opportunities, and potential flow effects. The source is experienced users or resource experts.

Typical approach
Identify a list of experienced recreation users or resource experts, usually through networking. Develop questions for identifying opportunities, potential flow effects, or other relevant issues. Conduct the interviews (with documentation), analyze responses, and summarize findings.

Product
Summary sections in a Level 1 report will identify existing and potential recreation opportunities, describe whether those are likely to be flow-dependent, and suggest potential flow-related issues or assessments (if possible). Lists of interviewees and systematic notes from interviews are commonly provided in appendices.

Responsibilities
Utilities (or their consultants) have primary responsibility, but agencies and stakeholders can help develop the networking sample, or review interview questions and findings. Recreation groups can be particularly helpful for finding individuals that use the river for recreation.

Additional issues
Collaborative development and review of interview lists by agencies and stakeholders is often helpful to ensure the interviewees represent a sufficient diversity of user types.

Systematic documentation of interview notes can make findings in a Level 1 report more transparent.

The number of interviews and level of coding and analysis involved in this task depends on the resolution needed. For a Level 1 report, even a few interviews, limited qualitative summaries of interview results, and occasional "personal communication" citations may be adequate. For a Level 2 or 3 report, more interviews, quantified analysis or responses, and summary statistics or graphs may be more appropriate.

Cautions & limitations
Interview panels may be small in a Level 1 effort, limiting the usefulness of statistics to represent group evaluations about flows or access. Interview information is best for learning about a river's characteristics, past use, and potential flow-related issues rather than definitive evaluations for specific groups.

"Representativeness" of panels is a major issue, especially when interviewees are developed through "self-selection" techniques (e.g., requests for interviewees made through a newsletter or on a list serve). Active networking designed to reach different parts of a recreation community is likely to be more successful.

Experienced users (right) or locals (above) may have considerable knowledge about recreation use and flow effects. Structured interviews help capture this information, but careful documentation and attention to "representativeness" are important.

Documentation Needs and Explicit Criteria for Progressing to Level 2 Studies

Some fishing opportunities are less flow-dependent than others. Shore-based fishing with spinning gear on Alaska's Kenai River (left) is excellent through a wide range, from mid-summer high flows to lower fall flows. In these situations, a well-documented Level 1 effort may be sufficient.

A Level 1 report should integrate findings from the study options above, clearly documenting information sources, summarizing findings, and linking those to raw data when appropriate. The report should identify recreation opportunities along the river, suggest whether there are flow-dependent attributes for each, and assess whether project operations are likely to have impacts on those opportunities. When there are multiple opportunities or reaches with potential project effects, these should be prioritized from those requiring more to less information.

Agency and stakeholder review is critical, but how that is accomplished depends on the licensing model in use (traditional, collaborative, or integrated; see sidebar). In general, the earlier this report can be completed and distributed, the better. This allows more time to develop intensive studies (if or when those are necessary), and can help direct resources to the opportunities and reaches that need them most. It also can serve as an "early warning" to work groups in other resource areas (e.g., fisheries, cultural) about which recreation opportunities are likely to have flow-related impacts, and it may lead to early articulation of likely flow regime requests. The exchange of information between resource work groups is among the most challenging aspects of relicensing efforts, and early Level 1 information allows that to begin sooner.

One output of the report should be explicit decisions about whether additional study is necessary for each opportunity and reach. While the utility and consultants typically make the case for these decisions in their report, review by agencies and stakeholders (via working groups) can make those decisions more collaborative, or allow early identification of disputes. This should limit additional information requests later in the process.

Ultimately, the decision is whether Level 1 information is sufficient, or if additional study is necessary. This decision rests on answers to several questions:

- Are there flow-dependent recreation opportunities on the river segments?
- Are flow-dependent opportunities affected by project operations?
- Are flow-dependent recreation opportunities "important" relative to other resources or foregone power generation? If certain recreation opportunities will not be considered when determining project operation decisions (e.g., if agencies and stakeholders agree that flow releases will be primarily driven by biological needs for an endangered species), more detailed information about flows may be unnecessary, and Level 1 information may be sufficient (assuming it documents stakeholder and agency agreement about this evaluation).
- Does Level 1 information precisely define flow ranges and potential project effects for each flow-dependent opportunity? For example, flow ranges for a commonly boated whitewater reach may be sufficiently well-known and agreed upon, and there may be no need for additional study.

If none of these questions are answered affirmatively, Level 1 information is probably not sufficient, and more intensive study (Level 2 or 3) may be necessary.